United Nations Industrial Development Organization

Distr.
LIMITED

ID/WG.62/23
12 August 1970

ORIGINAL: ENGLISH

Symposium on Maintenance and Repair in Developing Countries

Duisburg, Federal Republic of Germany, 10-17 November 1970

HANDLING AND STORING OF SPARE PARTS AND MATERIALS FOR MAINTENANCE PURPOSES ON THE PLANT LEVEL

by

W. H. Brown
British Steel Corporation
Newport, United Kingdom

Organized in co-operation with the German Foundation for Developing Countries and the Association of German Machinery Manufacturers (VDMA).

The views and opinions expressed in this paper are those of the author and do not necessarily reflect the views of the secretariat of UNIDO. This document has been reproduced without formal editing.

id.70-4459

CONTENTS

INTRODUCTION

1. THE POLICY CONCEPT

2. BASIC ORGANISATION

3. PLANNING MATERIALS HANDLING

4. HANDLING AND STORAGE EQUIPMENT

5. CONTROL SYSTEMS AND PROCEDURES

6. COMMUNICATIONS AND INFORMATION HANDLING ON PLANT

7. ACCOUNTING CONTROL SYSTEMS

8. APPENDICES

INTRODUCTION

The demands of Modern Plant Management for higher productivity, and cost improvement, previously applied to production processes, now equally applies to Maintenance Practices, in these modern times. Consequently the Handling and Storing of Spare Parts and Materials on the plant level, for maintenance purposes, most now be considered as part of the Maintenance Practice.

Much has been written on effective Maintenance Management, and the old adage of a "necessary evil" has evaporated with the realisation that this function is an integral part of the whole function of any production or process unit - large or small.

Consequently the importance of the service organisation supporting the maintenance function in the supply of spare parts and materials, needs no further emphasis.

The proper control of spare parts, materials and supplies can be an important factor in reducing maintenance costs, and to achieve this end, the organisation set up to exercise this control must in itself generate a high standard of efficiency.

The efficiency or performance of this service can be related to an increase or decrease in plant down times, corresponding to increased or reduced maintenance expense, arising as a result of inferior supplies and waiting time, or reliable material promptly delivered.

Equally, great care has to be taken not to promote stock investment levels absorbing capital which would be more usefully employed in promoting higher and more efficient production levels.

Therefore, as it is a vital essential in any effective economic Industrial Policy to place quality and reliability high on the list of requirements, it is equally essential to provide the service of spares and supplies on the same basis.

Modern technologies previously considered as fringe professions involving metallurgy, automation and instrumentation, although increasing the complexity of maintenance control and application, have the primary objectives of higher process efficiencies and cost reduction. These in conjunction with Accounting Techniques in Budgetary and Maintenance Costs Control, provide the basis for sound Maintenance Practice.

Consequently in highly sophisticated production units delays in the rectification of unforeseen stoppages, caused as a result of the premature failure of equipment or unscheduled extensions to the planned maintenance down times, must inevitably be calculated in terms of substantial financial and production losses.

Having established the background and the essential requirements in providing an effective organisation for the handling, storing and supplying of spares and materials to maintenance and process units, it will be appreciated that such an organisation must in itself be sophisticated in order to achieve the desired result.

(1) THE POLICY CONCEPT

(1.1) Normally the organisation set up to handle spare parts and materials is located either within the Administrative or the Engineering Control structure of a Plant, for Management Control purposes. This organisation of necessity must have direct communications with all operating or functional sections of the Plant.

(1.2) Essentially therefore, on medium and large Plants the Stores Control section requires to be autonomous in concept. Equally the organisation must be capable of operating procurement and supply systems which will involve Administrative, Accounting and Engineering skills, to ensure an efficient and economic service.

(1.3) The proximity of the Stores Unit/s to the user Plant sections is an important economic factor, and this should be carefully considered with regard to future plant expansion or development, when determining the location.

(1.4) Depending upon the type and size of the Industry involved Stores Organisations usually fall into two categories, i.e. a Centralised single unit or several units closely located in one area, alternatively, a Decentralised organisation having several units each located adjacent to the Maintenance Section of a major plant unit.

(1.5) In the latter case each Unit would have the special function of providing the particular spare parts for a specific plant process, other than the general or common supplies required. These individual units would be controlled directly from a Central Distribution Stores, operating as the Administrative Control Section.

(1.6) Either system has operational problems and inefficiencies. Largely the determination as to which system will provide the best service at minimum operating cost, will depend upon the amount of capital available to establish the organisation, coupled with the volume and investment in spares and materials to be stocked.

(1.7) Type of Organisation

In general, the following aspects should be considered when deciding upon the type of Stores Organisation to be projected.

(1.8) The Centralised Organisation

a) The ever present possibility of insufficient storage space as a result of protracted or varying supply times necessitating increased stock holdings.

b) The necessity to relocate stocks arising from variations in stock quantities held, to prevent multi-location problems.

c) The tendency for Plant Maintenance or Operational Personnel to establish stocks of spares and materials on plant local to their activities, giving rise to waste or loss and involving extra expense.

d) Operating a continuous transport service of supplies to, and recovery from the Plants. This service if inefficient and under emergency supply conditions, can extend maintenance times, thereby creating production delays and financial losses.

(1.9) The Decentralised Organisation

a) The extension of Manning to operate the organisation.

(1.9) b) The extension of communications from the Central Control, and the involvement of sophisticated data recording techniques.

c) The provision of central and local distribution transport, and the extension of mechnical handling facilities.

(1.10) Objectives

The evaluation of each system requires a considerable amount of study, research and fore-knowledge, resulting from which several imponderable aspects will still remain.

(1.11) Consequently, joint consultation with the suppliers and the users is most essential to overcome some of the imponderables to be met in this kind of study, before eventual decision is taken.

(1.12) This kind of joint consultation not only eradicates waste in effort, and money, but promotes the correct atmosphere and relationship in developing efficient material control systems.

(1.13) It is too late to start thinking about material handling and storing when the material is delivered. The effort has to be made at the ordering stage. As necessary all control personnel directly involved in this process, should be consulted, to achieve the desired results. Equally this must be done at the inception or introduction of any Stores Development project.

(1.14) Ostensibly the results to be aimed at are :-

a) Minimum manual labour costs.

b) Flexible holding capacities when and where required.

c) Minimum volume of material in transit.

(1.14) d) Efficient stock control and therefore minimum capital outlays on stockholdings.

e) Efficient utilisation of service transport.

f) Maximum volume of production.

g) Improved Industrial safety.

h) An overall increase in efficiency.

The effectiveness of the policy determined will depend upon the correct functioning of the Planned Organisation supporting that policy.

(1.15) This fact has been demonstrated over thousands of years of history, where there was a need for the conservation of supplies for ready use. This function has now become a science, concerning itself with Inspection and Testing of these supplies, storage conditions, protection and security, to name only a few of the many requirements to be met. Today many industries are classified by their ability or inability to operate an efficient supply and stock control organisation.

(1.16) It will be obvious therefore that to meet the multiple of conditions and circumstances surrounding these operations, that it is a fundamental requirement for Stores Management, in conjunction with all other interested parties, to lay down practical procedures or rules. In this way reasonably smooth working can be achieved in all sections, and such efficiency promoted that service costs can be maintained at sensible economic levels.

(1.17) In essence the strategy recommended in establishing policy can be summated as follows :-

a) <u>Service</u>

To provide or progressively improve the quality of the service to the process units or plant sections concerned.

(1.17) b) Finance/Costs

To budget and control all expenditure.

c) Productivity

To increase productivity on a regular planned basis.

d) Development

To develop the service given in the light of the best available knowledge, and to the advantage of the plant sections concerned.

e) Personnel

To provide a well motivated efficient staff and to develop the skills and aptitudes of that staff to the best advantage.

f) Consultation

To consult with associated plants and organisations on common problems.

(2) THE BASIC ORGANISATION

(2.1) In setting up a stores organisation, the policy having been agreed, and the capital involvement having been established determination of the minimum staff required, in grades and job descriptions is the pre-requisite. Generally such employees are established in staff and works grades, covering Administrative duties on a staff basis and Manual operational duties on a works grade basis.

(2.2) The Administrative Section (Clerical)

Deals with the paperwork systems adopted for the control and recording of all spares and material movements. They would also liaise with other departments, such as the Purchasing and Accounting Sections, should these functions be separate from the Stores Organisation.

(2.3) The Operational Sections (Manual)

Usually supervised by staff personnel, and utilising works grade personnel, are responsible for the security, movement and protection of all spares and materials in store. They would also maintain such records as are necessary for material flow control.

(2.4) Inspection Section (Engineering)

Would deal with all incoming spares in particular, and a variety of general supplies, checking limiting dimensions to drawing, material specifications, workmanship and material condition, before such materials are passed to storage.

(2.5) It will be appreciated that such a unit would only normally be introduced in large or integrated types of Plants, utilising Spares of considerable value, and unit holdings of Insurance Spares, considered critical for Plant continuity.

(2.6) The integration of these sections, and their relationship with the Service and Production or Process units on the Plant, has then to be evolved by the introduction of control systems. These systems in the main should be designed to record or produce information for control purposes, or requiring action, so that the whole organisation is in effective motion, to continuously maintain the service.

(2.7) The main systems to be considered are :-

a) Inventory and stock controls.

b) Receipts and distribution procedures.

c) Inspection control and reporting procedures.

d) Recovery and repair systems.

e) Budgetary and expense control sytems.

(2.8) Inventory and Stock Controls

In order to establish these controls, it is first necessary to promote a comprehensive inventory or catalogue of essential spares, insurance spares, and consumable or general supplies. These schedules would normally be prepared, in association with the equipment or machinery supplier, and/or upon previous experience obtained on another similar types of plant.

(2.9) The evaluation of these schedules on the basis of annual usages can then, with Management approval, become the basic budgets for inventory and accounting purposes.

(2.10) Subsequently as statistics are generated, modifications to the operating budgets can be introduced, including allowances for depreciation of plant, due to the normal extension of maintenance, as the result of wear becomes more effective on plant operation.

(2.11) In promoting separate identifications for spares, either as components or assemblies, and general supplies termed "consumables", separate stock or code numbers have to be introduced. Differenciation requires to be made, between specific spares connected with particular equipment or machinery, and those spares which have a common application to a large variety of equipment or plant units. The remainder being dealt with in a "consumable range" of materials.

(2.12) Depending upon the data collection system or equipment used, in the recording and accounting system, simple or compound codes can be used. Generally these codes should follow the pattern outlined below, and contain the following information :

a) The Departmental Code Number.

b) The specific Process Unit or Plant Section Code Number.

c) The numerical sequence number, of all components to be carried, as spares stock for the equipment concerned. Spares Assembly numbers should be incorporated where component spares and assemblies are both stocked.

d) Differenciation coding to distinguish between Electrical/ Mechanical/Automation/Instrumentation etc.

Provided the data collection system can accommodate say ten digits then for example a stock or code number for a mechanical spare could be 6501/307/002

(2.13) In this example 65 is the plant or process section number, 01 is the equipment or machinery reference in this section, 307 is the assembly section of the equipment or machinery concerned, and 002 is the actual spare part code involved. Similarly 6502/ etc. could apply to electrical equipment on the same plant section etc.

(2.14) This type of coding system is essential when considering spares inventories of 60/100,000 items and above, whereas simpler forms can be used for considerably smaller spares inventories.

(2.15) Considering common spares coding, e.g. bearings in multiple use in any plant or process unit, it may be adequate to purely prefix a numerical series, by a single or two digit reference, to give adequate identification e.g. 40/002041.

(2.16) Similarly with general supplies, i.e. consumables, a simple two digit prefix system is adequate for control purposes, provided sensible segregation and grouping of these supplies, has been determined initially.

(2.17) Inventories or catalogues mainly fall into four categories, for stock control purposes, these are :

a) Replenishment on a cyclic calendar basis usually arising through Contract Orders on suppliers.

b) Safety stocks for essential supplies where uncertainty exists or usage is irregular.

c) Anticipated requirements for stock above normal holdings, as a result of forward planning for a specific maintenance task.

d) Insurance stocks, critical for the continuity of plant or process, and whose replacement times would be extremely protracted, or are supplied from sources outside the country requiring them.

(2.18) In establishing efficient inventory programmes, certain objectives require to be considered. These are :-

a) To arrange with Management and Maintenance Control the quantitative terms of the requirements, and to ensure that the Stores Control Personnel can operate consistently within these terms.

b) To balance the Inventory, and to operate within the Budgeted Investment level.

c) To ensure an adequate level of service to the Plant or Process Units.

d) To promote a high proficiency in the control procedures, and a high utilisation of the administrative and operational personnel.

e) To adopt simple calculation techniques within the control procedures, which can be carried out on a routine basis by clerical staff.

f) To promote limiting budget rules in quantitative terms which if exceeded will require control by management action.

g) To provide exception reports for management decision and action.

(3) PLANNING MATERIALS HANDLING

(3.1) Any store or warehouse should be established as a planned space area, capable of the efficient handling of spares and materials specific or variable at minimum cost.

(3.2) The greater part of this function is handling, either manually or by means of mechanical aids, or a balance of both to give the best efficiency in the operation.

(3.3) The cost aspect in this connection is of vital importance, in that such costs add to the oncost of a product but do nothing to increase the value of that product.

(3.4) These costs can represent from 15% to 85% of the product cost, and consequently, this function offers greater scope for improvement and ingenuity than probably any other field of industry.

(3.5) In these competitive times, the cost of non-productive services in any sphere of industry is all important. Essentially therefore more sophisticated techniques are continuously being introduced to achieve better results and reduce these costs.

(3.6) Consequently Materials Handling stands high on the list of functions which must be under constant review, and in particular the irrecoverable material and energy losses arising from bad practice.

(3.7) It is only in recent times that greater attention has been paid by Plant Management to Stores and Materials Handling. Previously their attention generally has been focussed upon improving production process or practice, in order to sustain competitiveness in their field of industry.

(3.8) Arising from this emphasis on improved equipment and tooling, and on the development of work study, value analysis, and incentive schemes it becomes obvious that without a highly effective Spares and Materials service, such objectives could be jeopardised. Therefore, unless suitable investment and consideration is injected into this function, to permit it to achieve the necessary efficiency, economies in production and financial costs, will not necessarily be achieved.

(3.9) There are three distinct cost centres in operating a stores organisation - labour, space and equipment. Depending upon the availability of each, and the policy adopted by Management, the whole operation can be very expensive, without the necessary efficiency being achieved.

(3.10) This type of problem can be resolved by the introduction of modern techniques in space saving methods and equipment, but this usually calls for considerable capital investment.

(3.11) Consequently, in adopting a philosophy which will be viable within the prescribed limits of the organisation concerned, the reasons for the function requirement must first be considered.

Briefly these are :

a) To control a variable flow of spares and materials, either as a result of Purchasing or arising from the Plant or Process production.

b) To ensure Plant or Process availability by safeguarding any interruption of these supplies.

c) To provide an autonomous control at an economic cost, compatible with a high level of service.

(3.12) Accepting these reasons and conditions then the variation in the operating requirements have to be analysed.

These are :

a) Dealing with fast moving spares, and consumable materials.

b) Dealing with slow moving spares, and materials.

c) Dealing with a combination of both fast and slow moving spares and materials.

(3.13) It is essential therefore, for handling and storing pruposes, that decisions have to be taken as to which of the three categories the stores or spares should be included. It is equally important to establish, in what ratio these are expected to be handled and stored.

(3.14) it will be appreciated that there can be a considerable difference in the equipment, and facilities required, for the different categories to achieve the desired efficiency.

(3.15) Consideration must also be given to the material and physical characteristics of the spares and stores concerned, to ensure proper handling and storing without damage or waste in energy.

(3.16) All of these aspects must be given full and proper consideration, when designing the layout, and selecting the equipment necessary for the stores organisation.

(3.17) In many instances planners have to adapt existing plant buildings, or part of such buildings. This generally arises as a consequence of the emphasis on capital expansion of production or process units. Under such conditions, stores are still expected to be capable of the flexibility required to meet rapid changes in the production and maintenance services, resulting from order book fluctuations.

(3.18) From the foregoing it will be appreciated that, to be forward looking, under all conditions, the organisation requires not only to maintain flexibility, and a high level of service, but to be continuously motivated, anticipating change at all times, but in essence - dynamic.

(3.19) Irrespective of the way in which a store is established either as a result of the acquisition of existing premises, or built to Specification, space conservation within the store is of vital importance. Without such intention, the essential flexibility or the dynamic control under variable conditions will be lost.

(3.20) There are various systems and developments in this respect, all with the same objective in mind: - space conservation, and in general these systems can be defined as follows :-

a) Permanent or Fixed Locations

Inferring Areas of fixed storage equipment, such as bins or racks, specifically calculated to hold predetermined capacities, and set out in stock or code number series.

b) Group or Area Locations

Of a flexible capacity, catering for loose pallet or stillage equipment, or multiple floor loads, such as bagged materials, and capable of random storage for a reasonable time cycle.

c) Block Storage Locations

These in essence are areas of very high density, with large holdings of similar spares of materials, usually received and issued in large quantities, and suitably arranged for mechanical handling.

(4) HANDLING AND STORAGE EQUIPMENT

(4.1) Basically the variation of design and size/capacity of the storage equipment selected, should be based upon the result of a study of the number of unit items to be held in each type of storage. This study should be related to the economics of Handling, Purchasing, and Plant usage factors over an appropriate time cycle. This will result in the establishment of "unit load" factors, for each type of Spare or Consumable item carried in stock.

(4.2) These unit loads according to size and weight will automatically determine whether they can be handled manually, or by mechanical aids, but close consideration must also be given to ensure the maximum of standardisation, to achieve the greatest economies in operation.

(4.3) The necessary requirement to utilize maximum space height in any building has led to many developments in handling aids, e.g. pallet trucks, fork lift trucks, stacking trucks, side-loading trucks, hoists, cranes and conveyors and each as required can be modified with suitable attachments for special applications.

(4.4) The obvious advantages of these aids are flexibility, speed in operation, stacking, loading and transporting, with one man operation.

(4.5) The only simple rule arising from their use is that spares and materials should not be placed directly onto the floor, or on fixed racking, but should be contained on a transportable pallet, or supported on timbers, to allow direct access by the lifting equipment in use.

(4.6) Pallets used in conjunction with a fork truck, enables spares and materials to be handled efficiently and safely, by a smaller number of operatives.

(4.7) In modern practice, Suppliers will load the materials on pallets, to facilitate more rapid handling at the reception area. Without this facility, extensive transport delays will arise, either as a result of the necessity to resort to manual off-loading of the supplies, or otherwise due to transport congestion in a busy store, where manual work will have no precedence over fork truck handling of receipts.

(4.8) Unit loads in palletised form can if desired, be transported directly to the Production or Processing Unit, and so avoid double handling of such loads.

(5) CONTROL SYSTEMS AND PROCEDURES

(5.1) The control procedures to be implemented are generally as follows :

a) The receipt and checking, of all incoming spares and stores against prepared documentation.

b) The controlled supply or issue of such materials to Plant and the certification of issuing documentation.

c) The maintenance of a reliable location control system to effect a rapid service.

d) Ensuring the security, protection and correctness of the supplies stocked.

(5.2) These routine procedures require constant supervision to maintain efficiency, basically because they are routines. They are necessarily introduced to reduce possible production orfinancial loss, arising from errors or omissions and creating emergencies on Plant.

(5.3) Irrespective of the size, type or complexity of any stores organisation, Control Procedures are almost as essential as the materials stored, if effective economic ordering and financial controls are to be maintained.

(5.4) Basically these controls should in all cases be related to essential "disciplines", affecting Management and Staff alike, in order to generate the common purpose of continuous motivation within the service.

(5.5) Consequently parameters require to be set up in Capital Controls, Expense controls, limitation on varieties of supplies, and equally time control factors.

(5.6) All of these requirements can be termed "Basic Budgets", against which operating performance requires to be measured on a routine if not continuous basis, to produce the best possible relationship between the cost of the whole operation and its generative effect on Plant Maintenance.

(5.7) Such section budgets are part of the overall operating plan of any Plant, which consists generally of a series of separate but interlocking plans, covering all main plant operations of functions. Each plan is dependent upon the others maintaining their objectives, to ensure the successful accomplishment of the overall operating plan, and the profitability of the Plant.

(5.8) The Order Control system within the stores organisation for the Purchasing of Spares and Supplies, must be aimed at the production of the minimum number of orders raised for any specific Spares or Supplies group. They must ensure a constant, but safe minimum quantity and investment level for these supplies, commensurate with Plant requirements.

(5.9) This in general means that contract orders require to be set up, against which stores administrative personnel can obtain supplies, by simple communication usually on a "cyclic" or calendar period.

(5.10) The important aspect in this regard is that each group of orders must be evaluated against the budgeted allowance, to ensure compliance with the operating plan.

(5.11) Emergencies and other exigiencies will arise from time to time, and consequently excessive budget conditions require to be permitted over a short period of time, provided these are eventually corrected over a given financial control period, either monthly or quarterly.

(5.12) In order to ensure effective control, Management practice in this connection is simply to maintain a moving average graph against each supply group and plotted against the budget factor.

(5.13) This arrangement permits a limited amount of flexibility within the purchasing programme budget to cater for unusual conditions while retaining management control of the situation.

(5.14) Concerning safety stocks for essential supplies, where the usage is irregular, these also can be controlled on a budget and contract supply basis related to maximum and minimum stock controls. These are not necessarily re-ordered on a routine time cycle, but according to the minimum stock situation existing at any time. It is necessary however to ensure that arrangements have been made under the contract for the supplier to maintain "Buffer Stocks", thereby permitting investments to be controlled at acceptable levels.

(5.15) Likewise the evaluation of the orders raised and graphed on a moving average basis, provides the basic control for management.

(5.16) Where specific items and insurance spares critical for production continuity are concerned, again in a limited way contract conditions can be established provided that these items are manufactured within a reasonable distance from the Plant, or are proprietary items reasonably available.

(5.17) Otherwise operation on a maximum/minimum closely controlled stock review, after each issue has been made, is the most satisfactory method of securing the right balance in stock availability and investment control.

(5.18) To support and maintain this type of system, controls require to be set up to deal with delivery time variations, and to examine all the possibilities of effecting repairs to used spares, on a routine basis and, where cost savings are involved.

(5.19) These controls are normally introduced or directed in conjunction with Senior Maintenance Personnel, who must satisfy themselves that the efficiency of the repaired item will be equal to that of a replacement.

(5.20) There are of course major spares items of considerable capital cost, wherein replacement must be subject to Senior Management decision, and usually such items are catered for in capital Plant Budgets.

(5.21) It will be appreciated therefore that control procedures to be established in the Purchasing section of the organisation and to be effective must emanate from Management. These controls will operate through the stratas of the service organisations each having limiting authority, established as a discipline right down to the clerical section, who normally initiate the whole function.

(5.22) Supply orders having been satisfactorily produced, progress control then takes over, which can either be as a routine function, or "by exception", according to the type of supply involved.

(5.23) Routine progressing would apply generally to essential spare parts, enquiries being made with suppliers in advance of the delivery date to obviate unforeseen delays. In cases where delays are indicated this information can then be passed on to the Maintenance Control in adequate time, for alternative action to be taken as required.

(5.24) "By exception" progressing would normally apply to routine deliveries, where a variation of a few days would not jeopardise Plant availability. Usually this action arises as a result of advice from the Stores Administrative section, reporting the non-delivery of material against their control schedules.

(5.25) Receipts control is the next step in the system, and again a vital step in the chain of maintaining optimum service to the Plant. Errors and omissions at this stage can create interruption of supplies to the maintenance section in particular, resulting in an extension of the planned programme and involving financial and production losses.

(5.26) To assist the speed and accuracy of this function it is essential that receipts documentation includes copies of the official orders, or in their absence copies of the originating paperwork for the Spares or Materials required, to ensure that the description and quantity of the items received is in accordance with the order.

(5.27) Both being correct, and the condition of the material being satisfactory, then the paperwork having been completed, the materials can be removed to the stores location allocated.

(5.28) In cases where an Inspection section is utilised, then normally all spares items would be processed through this unit prior to location. In such circumstances, verification of the correctness of the receipt is confirmed by Inspection certification on the Receipt documentation.

(5.29) Regarding general supplies, it is essential where these are not fully checked or inspected that the location control personnel, not only ensure that the storage location is accurate but that these supplies are similar to those already in stock.

(5.30) Resulting from these actions the original documentation now updated requires to be registered and distributed to all sections concerned, namely :-

a) The Purchasing Department to allow closure of progressing records.

b) The Accounts Department to update stock and investment records.

c) The Maintenance Section to indicate availability.

d) The Financial Section to authorise the Invoice upon receipt.

(6) COMMUNICATIONS AND INFORMATION HANDLING ON PLANT

(6.1) The minimum information required for the distribution section of the Central or Area Store concerned, should be contained on a summary or analysis schedule of the Spares and Materials required by the Maintenance Section concerned and indicating the Plant delivery point, i.e. maintenance location on a Date/Time basis.

(6.2) This is not management information but arises as a result of forward planning on maintenance allowing time to ascertain the availability of supplies and the co-ordination of transport, to meet the requirements of the maintenance programme.

(6.3) On completion of the maintenance and the recovery of the unused supplies, the normal accounting practice of charging out the used supplies can then proceed with the minimum of paperwork and time.

(6.4) Within the same time cycle arrangements including works orders/ buyers requisitions can be produced. These orders or requisitions are raised for the replacement of spare parts, as necessary, and for repairs to be effected to recovered unserviceable spares, with the minimum of delay.

(6.5) The close co-ordination of this process can have a major effect in reducing the stock levels, particularly of spares, and consequently the investment levels of these spares.

(6.6) Recoverable Spares and other materials left lying around is gross waste and eventually if allowed to accumulate can become a serious safety hazard and security risk, as well as destroying the principles of good housekeeping.

(6.7) Management Techniques and Controls

As Plant and Process Development extends in any industry increasing the complexity, the need for a more rapid and easier flow of primary data assumes greater importance. This is particularly the case in respect of control information and to this end more sophisticated data collection techniques are being introduced continuously.

(6.8) Not so long ago, in stores service units of considerable magnitude, manual recording of all movements was the accepted practice, whereas within the span of a few years, the necessity to absorb, analyse, and report information accurately and speedily for control purposes has brought into common use Electronic Data/ Processing Units, utilizing Computer Control.

(6.9) Such equipment has major advantages over the manual systems, particularly in the speed of operation and the enormous memory or information banks which can be generated within the system. Such systems provide immediate availability of any of this information as required, without the laborious effort of searching through manual records.

(6.10) The expense justification of E.D.P. Units mainly applies in large Industrial Units, where as a result of a feasibility studies, savings and better performances can be achieved relative to the manual systems, whereas in small units it would be difficult to justify the purchase or lease of such equipment.

(6.11) However, it is equally feasible for a number of small Plant units to investigate the possibility of jointly obtaining this service or of obtaining such a system through a central computer service organisation.

(6.12) The relative costs of manual and E.D.P. systems can be calculated but it should be remembered that there are many unforeseen advantages in the E.D.P. systems which usually result in significant savings. These savings in the main result from more usable information or the rapid conversion of such information for better control which in turn produces cost savings.

(6.13) The greater the uses to which the Computer is put, the lower the unit cost, as the equipment can account for 75% of the total cost of the E.D.P. system.

(6.14) Computer systems have a very extensive application, other than information handling, and are being applied to Production Process Controls over a wide range of Industries. Under certain conditions they are also being applied to materials control and handling in large Stores or Warehouses, normally termed Automated Storage Handling.

(6.15) The main object in establishing an Automated Store is to reduce the overall cost of the operation. This cost reduction is achieved in savings in wages, handling, investment levels and other oncosts, while increasing the service levels of such stores.

(6.16) Most stores planners, would in the interests of efficiency, prefer to design the equipment and layout to meet the needs of their own problems, and the types of spares and materials with which they are concerned. In the interest of economy these desires have to be subjugated and standard equipment introduced wherever possible, to effect economies in Maintenance of the installed equipment.

(6.17) The operational requirements basically in an Automated Store, are no different to those in the conventional store, in that input is effected by fork lift truck or conveyors onto transfer pallets operating between input and issue conveyor systems and stacker cranes.

(6.18) Similarly with issues the process is reversed but the whole system is computer controlled, largely eradicating manual labour operating with manual record control systems.

(6.19) As stated previously the viability of sophisticated equipment of this nature can only be considered where capital is available, and the volume of materials handled is of a considerable magnitude. Primarily the end use will be to materially assist the supply service at a reduced cost, and that the capital outlay will be recovered over a period of about five years from commissioning date.

(6.20) These systems can be interlinked with planned maintenance programmes, where prior knowledge of the availabilities of spares and supplies is essential. Such an arrangement can have a major effect in increasing the effectiveness of the maintenance operations thereby promoting savings in maintenance costs and improved production performance.

(6.21) Feed back information is therefore essential in such systems to ensure that each section motivated complies with the procedure and peforms at optimum efficiency.

(6.22) With E.D.P. systems information feed back is the primary objective in order to promote further activity and to maintain the whole system in motion. It is essential such reporting is continuously monitored by more than one person, to prevent the possibility of oversight and error.

(6.23) With manual systems however it is essential to introduce Supervisors or Controllers wherein checking routines are employed to ensure no lapse in the system.

(6.24) Usually this type of control would employ calendar control schedules, statistical updating records, and probably registers to ensure that the routine disciplines are observed.

(6.25) Again with E.D.P. equipment as with manual systems the accuracy of all documentation is vital to the whole operation. Supervisory control and monitoring of this documentation is essential to ensure that the "disciplines" are being rigidly observed.

(6.26) Errors or omissions arising in the system as a result of malpractice on the part of operators, usually mean the reproduction of all documentation and the recirculation of the paperwork, giving rise to increased cost and delays.

(6.27) In cases where the receipts do not comply with the order specification or quantity, then exception reports require to be raised, and the action necessary to correct the situation included on these reports.

(6.28) When this action is completed and the materials are returned, or additional supplies are awaited, the system returns to the initial status of providing paperwork including the order copies to the receipts control point.

(6.29) Referring now to the cost aspects arising from the fulfillment of maintenance and production requirements, unless continuous vigilance by monitoring and evaluation of these issues is maintained, all of the preparatory planning and budgeting of the supply and investment aspects will be thrown into confusion.

(6.30) The information generated for these controls continuously revolves, starting with the ordering condition and terminating with the supply to plant, which activates the starting point again.

(6.31) Consequently, as in the case of many such activities, the diminishing effort toward the end of the sequence, equally applies in the control of this type of expense.

(6.32) Realisation of this defect in performance, makes it essential that the "disciplines" to be introduced to ensure control, must be even more stringent to achieve the correct Budget performance.

(6.33) As will be well appreciated the volume of separate issues arising each week in any size of Plant, relative to the receipts volume is extremely high, and can reach ratios of issues to receipts of the order of up to 100 to 1.

(6.34) It will also be appreciated that in the case of the materials receipts aspect the function is generally being handled by a limited number of trained personnel, as a total function, whereas, requests for supplies arise from a very much larger number of Maintenance and Production personnel. It is usual for Maintenance and Production personnel to consider the need to provide request notes as a function they could well do without and has no direct part in their activity.

(6.35) Herein lies the greatest danger in that supplies if continuously over ordered by plant personnel, to economise in their paperwork, can set a pattern of usage which of its own volition will destroy the concept of budgetary control, and minimum investment levels. This chain reaction if allowed to continue would seriously affect the overall operating plan.

(6.36) Consequently, serious consideration with some ingenuity, has to be given to reduce the problem of the Plant personnel, while maintaining the objective of expense control within the budget discipline.

(6.37) There are numerous systems employed and developed, as a result of such experience. It cannot be simply solved, by limiting or refusing to supply, as this creates frustration, and could result in labour discontent and reaction, resulting in reduced productivity, with consequent financial loss to the Plant.

(6.38) The basic requirements therefore must include the following :

a) The reduction or elimination of request documentation originated by plant personnel.

b) Wherever possible to arrange supplies to Plant on a regular or calendar basis.

c) Providing where necessary limited storage arrangements local to the activity centre, where, with the co-operation of Plant Supervisory, Maintenance or Process personnel, regular usage items of a general character can be obtained without further request paperwork.

d) Prompt dealing with the exceptions to the above, if unplanned and requiring to be supplied from a store remote from the activity centre.

(6.39) An analysis of the possible and preferred results to be derived from these proposals would be :-

a) The reduction or elimination of errors and omissions in the primary data arising from plant requests.

b) Reduced handling and transport costs between Stores and Plant, and obviating the possibility of the over ordering of small quantity requests.

(6.39) c) The elimination of delays in awaiting trivial supply items, but essential to maintenance productivity, and reducing or preventing additional expense arising, from material loss or waste left around the activity centre.

(6.40) To establish the control system for issues and embracing the foregoing requirement, it is at first necessary, as a result of a work study, or available statistics or a measure of both, to establish the limiting budgets. In these considerations Senior Plant personnel should be involved and the results approved by Management to ensure a fair compromise all round in the initial stages.

(6.41) Resulting from the usage/expense analysis obtained supply time sequences should then be established, having regard for high vehicle loadings, high transport utilisation to give minimum cost.

(6.42) The frequencies of delivery will obviously depend upon the volume of any commodity group required, and the storage capacity available on any plant section.

(6.43) The routine would then follow the practice of delivering the same groups of items to all plant stores in rotation, to be followed by the different groups on a cyclic basis.

(6.44) Depending upon the accounting system employed, it is possible to arrange that the receipts credits to stock, and the supply debits to Plant, can be processed through the accounts at almost the time thereby economising in all paperwork transactions and accounting activity.

(7) ACCOUNTING/COSTING

(7.1) The essentials in any comprehensive system of accounting and costing, related to the control of spares and other materials, should provide a complete analysis between the actual and the budgeted costs for all control functions.

(7.2) Such an analysis for example, would indicate over or under variances on the recovery of fixed expenses, resulting from changes in activity, in storage, handling, delivery, administration and maintenance functions.

(7.3) This information should be processed within the period under review, highlighting those expenses under each separate control function.

(7.4) Expense forecasting for cost control is today a common feature in Plant Management, the aim and effect being to reduce labour and material costs to a minimum, or to maintain these costs at an economic level, while promoting high productivity.

(7.5) Consequently the stores function, in providing to costs, accurate forward information of anticipated usages and therefore expense to be coupled to the forecast of maintenance costs, over any given period based upon the regulator systems in operation is of considerable importance.

(7.6) As a result of receiving this information Plant Managers are in a position to monitor the effect of their intentions before decisions are taken.

(7.7) Charges to plant should stipulate the demander and the plant section to be charged, to enable Plant Management to verify such costs.

(7.8) From the results of the costs information, continuously produced by the accounting costing system, performance trends can be generated, which if fully utilised by management, will promote many benefits in the improvement of maintenance costs arising as a result of :-

a) The better use and contol of maintenance spares and materials.

b) Focussing attention on high cost sections and high cost spares or materials usage.

c) Isolating weaknesses in particular plant items, resulting in modifications and improvement in performance being obtained.

d) Improved maintenance methods and the improvement in the supply and handling of spares and materials to plant.

oooooooooOoooooooooo

In conclusion, the foregoing has endeavoured in short form to cover in an narrative, some of the aspects of a Spares and Materials service on the Plant level.

The interrelationship of much of the subject matter is such, that there is no particular or logical sequence to the practices and systems discussed.

However, it is hoped that the philosophy and principles projected will prove of consequence to those contemplating introducing such a service and organisation.

(8) APPENDICES

(8.1) Order and Receipts Paperwork Flow Chart

(8.2) Expense and Budgetary Control Chart

(8.3) (a) Typical Order Master and,

(b) Summary Stock Requisition

(8.4) Typical Inspection Report Form

(8.5) (a) Typical Issue Notes and

(b) Spares and Consumable Supplies.

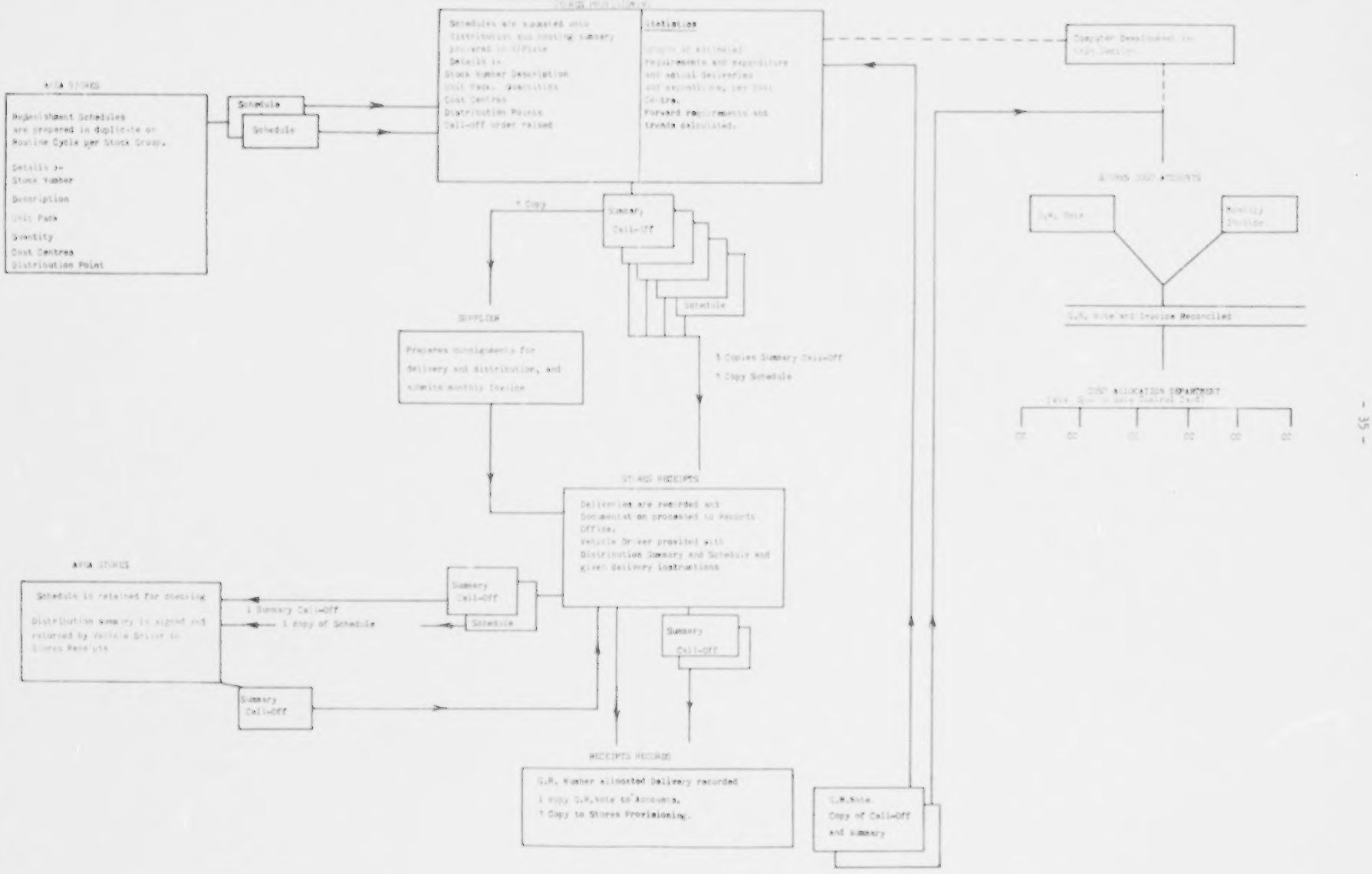
(8.6) Stock Record Cards

(8.7) Work Order Form

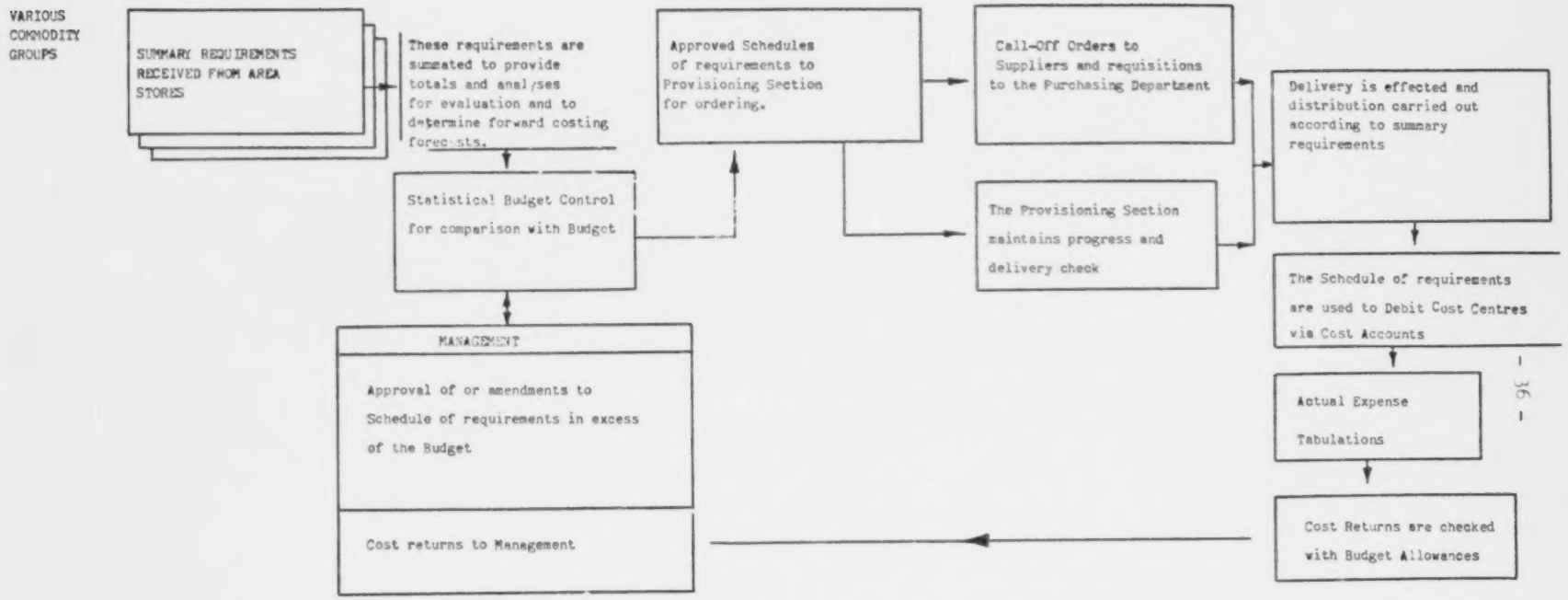
(8.8) Goods Received Note

(8.9) Distribution Schedule

(8.10) Consignment note


Schedules are summated onto Distribution and Costing Summary prepared in D/Files
Details :-
Stock Number Description
Unit Pack. Quantities
Cost Centres
Distribution Points
Call-off order raised
Statistics
Reports of estimated requirements and expenditure and actual Deliveries and expenditure, per Cost Centre.
Forward requirements and trends calculated.
Computer Developments in Hand Section
AREA STORES
Replenishment Schedules are prepared in duplicate on Routine Cycle per Stock Group.
Details :-
Stock Number
Description
Unit Pack
Quantity
Cost Centres
Distribution Point
Schedule
Schedule
1 Copy
Summary Call-Off
Schedule
SUPPLIER
Prepares consignments for delivery and distribution, and submits monthly Invoice
5 Copies Summary Call-Off
1 Copy Schedule
STORES RECEIPTS
Deliveries are recorded and Documentation processed to Records Office.
Vehicle Driver provided with Distribution Summary and Schedule and given delivery instructions
AREA STORES
Schedule is retained for checking
Distribution Summary is signed and returned by Vehicle Driver to Stores Receipts
1 Summary Call-Off
1 copy of Schedule
Summary Call-Off
Schedule
Summary Call-Off
Summary Call-Off
RECEIPTS RECORDS
G.R. Number allocated Delivery recorded
1 copy G.R.Note to Accounts.
1 Copy to Stores Provisioning.
G.R.Note.
Copy of Call-Off and summary
ACCOUNTS DEPARTMENT
G.R. Note
Monthly Invoice
G.R. Note and Invoice Reconciled
COST ALLOCATION DEPARTMENT
CC
CC
CC
CC
CC
CC

BUDGETARY CONTROL OF FORWARD EXPENSES


VARIOUS COMMODITY GROUPS
SUMMARY REQUIREMENTS RECEIVED FROM AREA STORES
These requirements are summated to provide totals and analyses for evaluation and to determine forward costing forecasts.
Statistical Budget Control for comparison with Budget
MANAGEMENT
Approval of or amendments to Schedule of requirements in excess of the Budget
Cost returns to Management
Approved Schedules of requirements to Provisioning Section for ordering.
Call-Off Orders to Suppliers and requisitions to the Purchasing Department
The Provisioning Section maintains progress and delivery check
Delivery is effected and distribution carried out according to summary requirements
The Schedule of requirements are used to Debit Cost Centres via Cost Accounts
Actual Expense Tabulations
Cost Returns are checked with Budget Allowances

APPENDIX 8.2.

APPENDIX 8.3. (a)

Copies to :-

ACCOUNTS DEPARTMENT
PURCHASING DEPARTMENT
SPARES DEPARTMENT
STORES

PURCHASE ORDER MASTER

Supplier's Code Number	ORDER NUMBER SN DATE	G.R.N. NUMBER DATE
	SANCTION NUMBER	ADVICE NOTE NUMBER
	REQUISITION NUMBER	INSPECTED BY
		G.R.N. CERTIFIED

ITEM	QUANTITY OR WEIGHT	DESCRIPTION	STOCK NUMBER OR COST CODE NUMBER	QUANTITY RECEIVED	LOCATION

YOUR QUOTATION	DELIVERY REQUIRED	DELIVERY QUOTED	TERMS OF PAYMENT	PACKING CASES QTY SERIAL NOS.
				CHARGED

APPENDIX 6.3. (b)

Date Group/Serial Number

TO COMMERCIAL DEPARTMENT

SUMMARY STOCK REQUISITION

Stock Number	Re-order Level	REQUIREMENT QTY	UNIT	to be ordered as :-	Delivery Required/Remarks	Location	Progress Reference	Order No. Date	G.R. Note No. Date	

APPENDIX 8.4.

INSPECTION REPORT

ENTRAL STORES

SERIAL NO.

UPPLIER	ADVICE NOTE NO. & DATE	DATE
DDRESS	SUPPLIER'S REFERENCE	RECEIPTS REFERENCE

DER NO.	REG'N NO.	LOCATION

CONSIGNMENT DETAILS

ANTITY	DESCRIPTION - INCLUDING PART/SERIAL NUMBERS	STOCK NUMBER

INSPECTOR'S REPORT

SIGNED INSPECTOR	SIGNED SENIOR INSPECTOR

DISPOSAL REQUIREMENTS

P.O.	TYPIST	CHECKED	DATE	
MEMORANDA				
				STORES CONTROLLER

TO: COMMERCIAL DEPARTMENT, ACCOUNTS DEPARTMENT OTHER DEPARTMENT _____ _____
SPARES DEPARTMENT, INSPECTION DEPARTMENT

APPENDIX 8.5. (a)

MECHANICAL

720021

SPARES TRANSFER NOTE

Description			QTY REQ'D DATE REQ'D	STOCK NUMBER		
DEPARTMENT			LOCATION	QUANTITY ISSUED		
DELIVERY POINT			UNIT OF ISSUE	MAINTENANCE EMP. COST CENTRE		
AUTHORISED BY DATE				COST CENTRE PLANT ITEM		
STOREKEEPER			DATE	TYPE OF CHARGE		
				SPECIAL CHARGE		
FOR USE BY SPARES, STORES AND ACCOUNTS DEPARTMENT ONLY						
OLD SPARE	SCRAP	RECONDITION	ENGINEER'S INITIALS	REGISTER NUMBER		
AVAILABLE FOR COLLECTION AT: DATE			REQ'N NO.	ORDER NO.	WORKS ORDER NO.	
DESPATCH TO			CARRIAGE/CHARGE TO		DATE OF DESPATCH	
			DESPATCHED PER	CONSIGNMENT NOTE NO:		
			PACKING	DESPATCHED BY		
SPECIAL INSTRUCTIONS			PACKING REF: NO.			

APPENDIX 8.5. (b)

MECHANICAL

CONSUMABLE STORES WITHDRAWAL NOTE

(One Item per Withdrawal Note) No: 92048

Description		Quantity Required	Date	
			Stock Number	
Charge to		Unit of Issue	Quantity Issued	
			Maintenance Employer cost Centre	
Deliver to:-		Loc/Bin	Cost/Centre Plant Item In which used	
Date Required			Type of Charge	
Required By:- Engineer	Issued By:-		Special Charge	

APPENDIX 8.6.

STOCK RECORD CARD

ROL_____ ROQ _____ STOCK NO. _____

DESCRIPTION Supply Unit UCI

ALLOCATION / AREA STORES	CSB	MP	ES	CN	HM	ST.P.	INST	BF	CO	REF	AUTO		TOTAL

Consumption Rate Period Lead Time Location

Date/Ref.	Ord'd	Rec'd	Iss'd	Bal	Date/Ref.	Ord'd	Rec'd	Iss'd	Bal

APPENDIX 8.7.

WORK ORDER

NUMBER

PLANT

INITIATED BY

DATE TEL:

COST CENTRE

RECONDITIONED OR NEW

JOB CATEGORY NUMBER

SANCTION NUMBER

DRAWING NUMBER

SPARES TRANSFER NOTE NUMBER

SHOP JOB NUMBER

DELIVER TO

GOODS RECEIVED NOTE

NUMBER

DATE

CERTIFIED BY

DELIVERY NOTE NUMBER

INSPECTED AT CENTRAL STORES BY

ITEM	QTY. ORDERED	DESCRIPTION	STOCK NUMBER	QTY. RECEIVED	LOCATION
					LOCATED BY

GENERAL INSTRUCTIONS

RECEIVED AT C.E.W. STORES

DATE

STOREKEEPER

RECEIVED AT CENTRAL STORES

RECEIPTS REFERENCE

STOREKEEPER

RECEIVED AT PLANT

DATE

SIGNATURE

SPARES TRANSFER NOTE NO.

CIRCULATION:- STORES ACCOUNTS, SPARES DEPARTMENT COST ACCOUNTS. C.E.W.

APPENDIX 8.8.

GOODS RECEIVED NOTE

	Release Note Number Date Against Standing Order Number	G.R.N. Number Date Advice Note No.
Supplier's Code		Inspected by. G.R.N. Certified

Quantity	Unit	to be supplied as	Description	Stock No. or Cost Code No.	Quantity Received	Location

M.S. 98-2 CENTRAL STORES - RECEIPTS CONTROL SCHEDULE DATE: 0.00 Hrs. to 5.59. Hrs.

SERIAL NUMBER	SUPPLIER	PACKAGE/ CASE NUMBERS	ORDER NUMBER	CHECKED		TO INSP'N	TO FAC'N	TO LOC/T CONTROL	D.I. D.A.	DELIVERY SHEET NO.	PASSED TO RECORDS	REMARKS
				to A/S	to ORDER							

APPENDIX 8.10.

CONSIGNMENT - ADVICE NOTE							
TO:-				NO			
				DATE			
				R.T.B. CONTRACT NO.			
PLEASE RECEIVE IN GOOD ORDER THE UNDERMENTIONED MATERIAL		CARRIAGE		CUSTOMER'S ORDER NO.			
Wagon Number	Description	No of Articles	No of Cells	T.	C.	Q.	LB
TARE TICKET NO. VEHICLE NO.							
CARRIER							

NOTICE OF ANY LOSS OR DAMAGE TO THESE GOODS MUST BE GIVEN TO US AND THE CARRIER IN WRITING WITHIN THREE DAYS OF DELIVERY

NOTICE MUST BE GIVEN TO US IF THEY ARE NOT DELIVERED WITHIN TEN DAYS OF THE ABOVE DATE:

CONSIGNEES COPY